Strategic Play Among Family Members When Making Long-Term Care Decisions

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Abstract

This paper describes a strategic model of bargaining within a family to determine how to care for an elderly parent. We estimate the parameters of the model using data from the National Long-Term Care Survey. We find that the parameter estimates generally make sense and that the model is consistent with the data. The results have strong implications for using less structural empirical models for policy analysis. Keywords: Long-Term Care, Family Bargaining, Structural Estimation. JEL Classification Codes: C25, C78, J14

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1 Introduction

Although disability rates among the elderly have decreased between 1982 to 1994 (Manton, Corder, and Stallard, 1997), the number of disabled elderly individuals has remained approximately constant at 5.5 million (Spector, et al. 1999) because of population aging. Furthermore, the level of disability among those who receive long-term care has increased (Spector, et al. 1999). These demographic and health trends have coincided with a trend away from care provided by children in favor of continued independence and institutional care. While independent living may be desirable for elderly individuals when feasible and safe, this outcome may result even if it is not ideal because of family decision making dynamics. The high cost of institutional care often exhausts the resources of nursing home residents. Thus, many elderly individuals and their families rely on Medicaid to cover their long-term care expenses. Not only does nursing home care typically create a greater drain on private and public resources than does care by a family member, but institutionalization is likely to involve greater social and psychological costs for an elderly individual (Macken, 1986). The economic, social, and psychological implications of the trend toward independent living and institutional care highlight the importance of understanding families' decisions concerning care for an elderly parent.

Although predominantly empirical, the long-term care literature offers several theoretical models. These models vary along several dimensions: which family members participate in the decision-making process, which types of care and/or living arrangements are considered, whether family members have common preferences, and whether other decisions are determined jointly with long-term decisions.

Most of the existing theoretical models involve only one child in the decision-making process. For example, Kotlikoff and Morris (1990) restrict their attention to families consisting of an elderly parent and only one child. Pezzin and Schone (1996, 1997) and Sloan, Picone, and Hoerger (1997) present models that apply to families of any size, but only one child plays a role in the family's long-term care decision. Only Hoerger, Picone, and Sloan (1996) and Engers and Stern (1998) present models that accommodate a variable number of children and the possibility that all children play a role in long-term care decisions.

Given the variety of long-term care arrangements and the connection between care and living arrangements, one model cannot capture all possible aspects of a family's long-term care and living arrangements. Depending on the focus of the paper, the choice variables in these models involve living arrangements (Kotlikoff and Morris 1990, Hoerger, Picone, and Sloan 1996), care arrangements (Sloan, Picone, and Hoerger 1997, Engers and Stern 1998), or both (Pezzin and Schone 1996, 1997). Kotlikoff and Morris (1990) present a model where parent and child decide whether to form an intergenerational household or to maintain separate households. In Hoerger, Picone, and Sloan (1996), the family faces a third possible living arrangement for the parent: nursing homes. In Engers and Stern (1998) , the family decides whether the parent will continue to live independently without care, receive care from one of the children, or move to a nursing home. Pezzin and Schone (1996, 1997) jointly model living arrangements with the provision of care by the child (in this case, a daughter). In Sloan, Picone, and Hoerger (1997), the choice variables are not the type of care or living arrangement but hours of formal care (paid care) and informal care (care provided by the child).

Two of the papers in this literature assume that a single household utility function is appropriate in the context of elderly parents and their adult children. Corresponding to each possible living arrangement in Hoerger, Picone, and Sloan (1996) is a family utility function and budget constraint. In Kotlikoff and Morris (1990), the parent and child solve separate maximization problems if they live separately but maximize a weighted average of their individual utility functions subject to their pooled budget constraint if they live together. In this latter case, the weights are determined by a bargaining process. The remaining models in this literature (Pezzin and Schone, 1996, 1997; Sloan, Picone, and Hoerger, 1997; Engers and Stern, 1998) are game-theoretic and thus involve separate utility functions for each family member.

Since the provision of care by adult children may be determined simultaneously with their labor force behavior, ideally these two decisions should be modelled jointly. Pezzin and Schone (1996, 1997) model labor force participation of adult children jointly with care and/or living arrangements. Similarly, inter- or intragenerational transfers may be made as part of a family's long-term care decision. This possibility may be captured by assuming that the family pools its income (e.g., Hoerger, Picone and Sloan, 1996) or by explicitly modelling side payments among family members. Pezzin and Schone (1997) model intergenerational cash transfers jointly with caregiving, intergenerational household formation, and labor force behavior. In one of the models in Engers and Stern (1998), family members choose the long-term care alternative that maximizes their joint payoff and make any necessary side payments among themselves.

In all of these models, elderly parents and their adult children jointly select living and/or caregiving arrangements. Most of these models are game-theoretic and thus accommodate the possibility that elderly parents and their adult children have different preferences. However, with the exception of Engers and Stern (1998), the game-theoretic models in this literature are based on the assumption that only one adult child participates in the decision-making process. This assumption considerably simplifies modelling and estimation but obscures the dynamics within the younger generation In practice, more than one adult child in a family may participate in the family's long-term care decision, and adult siblings may disagree regarding the best source of care for an elderly parent. The potential disagreement among adult siblings and between adult children and elderly parents motivates the development of a game-theoretic framework where the players include the parent and all of her children. The potential disutility of certain outcomes (e.g., providing care, institutionalizing the parent) may generate strategic interaction among adult siblings. For example, a child may prefer to offer care for a parent in the absence of a similar offer from a sibling but may prefer not to offer care in the presence of a sibling's offer. The possibility of such strategic play suggests that a non-cooperative model may be appropriate.

Accordingly, we model the family's long-term care decision as a two-stage non-cooperative game. Following Engers and Stern (1998), the players of the game are an elderly parent who is functionally impaired but living independently and her[1] children. In the first stage of the game, each child simultaneously announces whether she offers to care for the parent. In the second stage, the parent chooses among the available care arrangements. These include any offers made by the children, nursing home care, and continued independence. In contrast to Engers and Stern (1998), bargaining among children and side payments play no role in our model; instead, the children interact strategically. Thus, our approach is more in the spirit of Bernheim, Schleifer, and Summers (1985) and Horowitz (1985). The assumption that children do not make side payments simplifies the model and provides a more intuitive error structure. We specify each individual's preferences as a function of the parent's characteristics and each child's characteristics and estimate the model using data from the National Long-Term Care Survey. To control for the potential endogeneity of some of the child characteristics, we use an instrumental variables approach (see Stern, 1995).

The econometric models in the long-term care literature are as varied as the theoretical models. Most papers present results based on nonstructural models (Boersch-Supan, Kotlikoff, and Morris, 1988; Wolf and Soldo, 1988; Kotlikoff and Morris, 1990; Lee, Dwyer, and Coward, 1990; Cutler and Sheiner, 1993; Hoerger, Picone, and Sloan, 1996; Sloan, Picone, and Hoerger, 1997), but several recent papers present results based on structural models (Kotlikoff and Morris, 1990; Pezzin and Schone, 1996, 1997; Engers and Stern, 1998)

Structural modelling of family behavior offers several advantages. First, structural modelling requires very explicit models where behavior is based on optimization and equilibrium conditions. Second, it enables one to address issues such as how families make decisions and how proposed policy changes would affect individual family members. This advantage can be illustrated by considering the implications of the nonstructural model in Cutler and Sheiner (1993). Their results provide implications of changes in Medicaid financing rules on behavior but not on the well-being of various family members. Thus, their work has limited value for efficiency and distributional analysis. Third, the results based on structural models suggest directions for better models and for better data. Fourth, structural modelling provides a step forward in the estimation of game-theoretic models. For these reasons, we estimate a structural model of family decision-making.

Two disadvantages of structural modelling are worth mentioning. First, given the high cost of estimating structural models, extensive sensitivity analyses are infeasible. Second, the high degree of structure in the model may drive some of the estimation results; however, with enough analysis, we can discover the

[1] Throughout the paper, we use female pronouns as the generic pronouns. This does not mean that only mothers need care or that only daughters provide care.

cause of our results. Alternatively, it is difficult to analyze a nonstructural model to the degree that it is underspecified.

The paper is organized as follows. Section 2 describes the data and provides descriptive statistics. Section 3 presents the theoretical model. The estimation procedure is described in section 4. Parameter estimates, comparative statics, and specification tests are reported in section 5. Section 6 examines the welfare implications of the game-theoretic model. Section 7 provides conclusions.

2 Data

To estimate the model, we use data from the 1982 and 1984 waves of the National Long-Term Care survey (NLTCS). The 1982 NLTCS consists of 6393 individuals aged 65 and older who were drawn from Medicare enrollment files and screened for functional impairment and institutionalization. Those who reported problems with activities of daily living (ADLs) or with instrumental activities of daily living (IADLs) but were not institutionalized passed the screen. Regardless of their living arrangements in 1984, all of the individuals who were eligible for the 1982 interview were also eligible for the 1984 interview.[2] Both the 1982 and the 1984 interviews include demographic information regarding the sampled individuals as well as their children. The sample selected for this paper includes 1952 individuals who responded to both the 1982 and the 1984 surveys, lived independently (as defined below) in 1982, had four or fewer children, and provided information on all of the essential variables. From an original sample of 25,401 individuals, 19,205 observations were rejected because they failed the 1982 survey screening test (and thus were not asked any of the relevant questions), and 1,306 observations were rejected because they did not answer the 1984 questions. Another 801 observations were lost due to missing information on gender, race, age, or education of the parent (with no reasonable way to impute the missing value), and 642 were lost due to missing information on the children. This left 3,447 parents for whom there was information on all of the essential variables or for whom the missing variable values could be imputed confidently (see below). We use the 1982 data to construct instruments for potentially endogenous explanatory variables and the 1984 data to estimate the model.

The dependent variable in our model is the parent's primary care arrangement in 1984. A family with n children faces $n + 2$ options: the parent could live in a nursing home, receive care from one of her children, or remain in the community without care from a child. A parent who lives in a nursing home is designated as receiving care from the nursing home (and not from children) even if one or more children also provide care. If the parent receives care from more than one child, we designate the child who provides the most care the primary caregiver. The last option includes cases where children live with the parent

[2] In the case of death between the two surveys, the deceased individual's next of kin was interviewed in 1984. The 1984 NLTCS also includes some individuals who did not pass the screen in 1982 but these individuals are not included in our sample.

but provide no care, cases where the parent lives with a spouse or a friend, and cases where the family hires paid care. We aggregate all care arrangements that involve neither institutional care nor care from a child because there are not enough observations in the data to treat them separately (care from friends or other relatives, paid care), they do not fit in the model well (paid care), or they are not a choice variable (marital status is exogenous). In particular, we assume that an existing spouse would provide some or all of the care for the dependent parent if he could; i.e., care by spouse is not a strategic choice in the same way that the choices we are modelling are. For ease of exposition, we classify this last option as "living independently."

Our explanatory variables include characteristics of the parent and the children. The parental characteristics are gender, age, education, marital status, race, and various ADL problems[3]. The children's characteristics are gender, age, marital status, distance from the parent, employment status, spouse's employment status, and number of children (i.e., grandchildren of the elderly parent). The model also includes measures of each child's characteristics relative to each of her siblings (e.g., dummy variables which indicate whether the child is the oldest male or the oldest female child and distances between children).

In addition to parental and child characteristics, the model includes three Medicaid policy variables that vary by the parent's state of residence. Specifically, the model includes the state's countable resource limit and dummy variables indicating whether the state has an income limit for Medicaid eligibility and whether the state has a "medically needy" program. In the presence of such a program, individuals may deduct medical costs from income in determining eligibility for Medicaid; thus, in such states, many middle-class individuals are eligible for Medicaid financing of nursing home stays.

Descriptive statistics are provided in Table 1. As indicated in the table, most of the sampled parents receive neither institutional care nor care from a child in 1984: 75.9% of the sampled parents live independently, 15.5% receive care from a child, and 8.6% live in a nursing home. The parents are predominantly white and female, roughly half are married, and the average number of problems with an ADL is 1.06. On average, these individuals are aged 77.4, have 9.3 years of schooling, and have 1.4 children. Almost half of the parents live in states with a medically needy program. The typical child is married, employed, and about 45 years old.

Given its size and scope, the NLTCS provides the best source of data for this analysis. However, as discussed in Stern (1995) and Engers and Stern (1998), the NLTCS has several serious flaws: the number of grandchildren in 1984 is severely underreported, the number of reported children decreases too dramatically between 1982 and 1984, and the income variable is noisy and frequently missing (and thus is not used in this analysis). There are also many discrepancies between reported values of certain variables across the two survey years; we use reasonable imputation methods developed in Stern (1995) to clean the

[3] To be designated as having a particular ADL problem, one must say that she has difficulty performing the ADL or uses special equipment to perform the ADL.

data.

3 Economic Model

Consider a family with an elderly parent and n children. The family faces $n+2$ potential long-term care arrangements for the elderly parent: the parent could continue to live independently, receive care from one of the n children, or move to a nursing home. These care arrangements are indexed with j where $j=0$ represents the outcome where the parent remains independent, $1 \leq j \leq n$ represents the outcome where the parent receives care from the jth oldest child, and $j=n+1$ represents the outcome where the parent moves to a nursing home.

Each family member i (also ordered by age beginning with the parent) receives utility V_{ij} from the selected care arrangement j. V_{ij} includes altruistic concerns for all of the other family members. Children may have altruistic concerns not only for their parent but also for their siblings. For example, if family member i is very concerned about the burden that family member j will incur if j cares for the parent, then V_{ij} will be lower than it would have been without such an altruistic concern on i's part. We decompose V_{ij} into common knowledge and private information components:

$$V_{ij} = \bar{V}_{ij} + \varepsilon_{ij} \quad \begin{array}{l} j = 0, 1, ..., n+1 \\ i = 0, 1, ..., n \end{array} \tag{1}$$

where $i=0$ represents the parent and $i=1,2,..,n$ represent the children. The $\bar{V}_{ij}$ component is common knowledge to all family members, but the ε_{ij} component is observed only by family member i. We normalize $\bar{V}_{i0}=0$ for all i without loss of generality. Further, we assume $\varepsilon_i = (\varepsilon_{i0}, \varepsilon_{i1}, ..., \varepsilon_{in+1})' \sim$ iid $N(0, \sigma_\varepsilon^2 I)$. Assuming that ε_i is independent of ε_l is not unreasonable and greatly simplifies computation. Assuming $E\varepsilon_i\varepsilon_i' = \sigma_\varepsilon^2 I$ is done only because it is unlikely we could estimate with any precision the parameters of a more general covariance matrix.[4]

Throughout this section, we illustrate the model with two examples. For ease of exposition, these examples abstract from the possibility of nursing home care. In both examples, the family includes two children, and the parent is indifferent among the three care arrangements. In family 1, each child would

[4] There are a number of different ways we could allow for a more interesting error structure. We would have to deal with several issues: solving for equilibrium, identification, and solving orthogonality conditions. We could allow for heteroskedasticity across family members. But, to implement such a specification, we would have to specify how the variance depends upon some subset of observed explanatory variables. It is unlikely that the existing data could help identify such effects. Any generalization of heteroskedasticity will have the same problems. Allowing for a person-specific effect is irrelevant because only variation across choices within a person matters here. Allowing for a choice specific fixed effect leads to Heckman's (1981) incidental parameters problem. Allowing for a choice specific random effect also has an identification issue. More interesting correlation structures cause all three problems mentioned above.

like the parent to receive care but would prefer not to be the caregiver. This family has a $\bar{V}$-matrix of the form

$$\bar{V} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & \frac{1}{2} & 1 \\ 0 & 1 & \frac{1}{2} \end{bmatrix}$$

where the rows represent family members (parent, child 1, and child 2, respectively) and the columns represent outcomes (parent remains independent, child 1 cares for the parent, and child 2 cares for the parent, respectively). In family 2, each child would like to care for the parent but would prefer for the parent to remain independent than to receive care from the other child. This family has a $\bar{V}$-matrix of the form

$$\bar{V} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & -\frac{1}{4} \\ 0 & -\frac{1}{4} & 1 \end{bmatrix}.$$

More generally, the family plays a two-stage, non-cooperative game to determine the parent's long-term care arrangement. In the first stage of the game, each child i decides whether to offer to be the primary caregiver taking as given the $\bar{V}$'s, the distribution of ε_l for all $l \neq i$, and her own realization of ε_i. Then, simultaneously, each child announces whether she offers care for the parent.[5] In the second stage, the parent chooses her most preferred care arrangement from among the available alternatives, namely any offers made in the first stage, nursing home care, and continued independence. We assume that the parent could always select nursing home care or continued independence. In some circumstances, however, these arrangements may be very undesirable. For example, if the parent's health prevents her from taking care of herself and the parent cannot afford to hire a private nurse, then the parent's utility associated with continued independence may be a large negative number. In turn, the probability that the parent would select continued independence in the second stage of the game may approach zero.

As mentioned earlier, a family with n children faces $n + 2$ potential care arrangement choices. The parent of n children thus has $(n + 2)!$ possible preference rankings over the potential care arrangements. Let the vector s_k represent the parent's preferences where s_k is a permutation of the integers $\{0, 1, ..., n+1\}$, k is an integer between 1 and $(n + 2)!$, and s_{kj} is the jth best alternative when preferences are s_k. Then the probability of a particular ranking, denoted r_k, is

$$r_k = \Pr[V_{0s_{kj}} > V_{0s_{kj+1}} \quad \text{for all } j < n + 1]. \tag{2}$$

If $s_{k1} = 0$, then the parent continues to live independently. If $s_{k1} = n + 1$, then the parent moves to a nursing home. Otherwise, the parent chooses her most preferred available outcome. In our examples, $s' = (s_1, s_2, .., s_6)$ is

[5] In the absence of a clear theoretical basis for determining the order of sequential offers, we assume that the children make their offers simultaneously.

$$s' = \begin{bmatrix} 0 & 0 & 1 & 1 & 2 & 2 \\ 1 & 2 & 0 & 2 & 0 & 1 \\ 2 & 1 & 2 & 0 & 1 & 0 \end{bmatrix},$$

and $r_k = 1/6$ for all k because the parent is indifferent among all six orderings.[6]

Given the available information about other family members, child i can compute p_j, the probability that child j offers care. Define $p_0 = p_{n+1} = 1$ for completeness in that continued independence ($j = 0$) and nursing home care ($j = n+1$) are always available. Later in the section, we show how to compute p_j, $0 < j \leq n$. The vector of p's can be used by child i to compute her expected net benefit of offering care, denoted u_i. Child i's expected net benefit of offering care is the difference between her expected utility if she offers care and her expected utility if she does not offer care. If the parent prefers continued independence or nursing home care to care provided by child i or if the parent prefers care provided by another child and that child offers care, then the outcome of the game does not depend on whether child i offers care. In such a case, child i's net benefit of offering care is zero. Thus, u_i may be expressed as the difference between child i's utility as primary caregiver multiplied by the probability that the parent would accept her offer if she were to make an offer and her expected utility if she does not offer care (and thus some other outcome is selected) given that the parent would have accepted her offer had she made one.

Consider the case where care provided by child i is the jth best overall alternative from the parent's perspective. Then let

$$P^o(i,j) = \sum_{m_1=j+1}^{n+2} \sum_{\substack{m_2=j+1 \\ m_2 \neq m_1}}^{n+2} \sum_{\substack{k:s_{kj}=i \\ s_{km_1}=0 \\ s_{km_2}=n+1}} \left[\prod_{l=1}^{j-1} (1 - p_{s_{kl}}) \right] r_k \tag{3}$$

be the probability that child i is the best available alternative from the parent's perspective in the event that child i offers care. Since care provided by child i is the jth best overall alternative, then this outcome can be the best available alternative only if the parent prefers this outcome to alternatives 0 (continued independence) and $n+1$ (nursing home care) and if the children representing the $j-1$ preferred alternatives do not offer care. Thus, equation (3) sums probabilities r_k for all k such that those conditions hold.

Consider the case where child s_{kl} offers care. Given that care provided by child i is the jth best overall alternative from the parent's perspective, also define

$$P^r(i,j,s_{kl}) = \sum_{m_1=l+1}^{n+2} \sum_{\substack{m_2=l+1 \\ m_2 \neq m_1}}^{n+2} \sum_{\substack{k:s_{kj}=i \\ s_{km_1}=0 \\ s_{km_2}=n+1}} \left[\prod_{\substack{t=1 \\ t \neq j}}^{l-1} (1 - p_{s_{kt}}) \right] p_{s_{kl}} r_k \tag{4}$$

[6] Since moving to a nursing home is not an option in our examples, there are $(n+1)! = 6$ possible preference rankings.

as the probability that care provided by child s_{kl} is the best available alternative from the parent's perspective in the event that child i offers no care but care provided by child i is the best available alternative in the event that child i offers care . Similar to equation (3), alternatives 0 and $n+1$ must be worse alternatives and, other than child i, the children representing the best $l-1$ alternatives do not offer care. Also, child s_{kl} must have offered care. Thus, equation (4) sums probabilities r_k for all k such that those conditions hold. Using equations (3) and (4),

$$u_i = V_{ii} \sum_{j=1}^{n} P^o(i,j) - \sum_{j=1}^{n} \sum_{l=j+1}^{n} P^r(i,j,s_{kl}) V_{is_{kl}}. \tag{5}$$

The term multiplied by V_{ii} is the probability that care provided by child i is the parent's most preferred available outcome given that child i offers care; it is the probability that care provided by child i is the jth best alternative $P^o(i,j)$ summed over j. The second term is a weighted average of the $V_{is_{kl}}$'s. Each weight is the probability that care provided by child s_{kl} is chosen in the event that child i does not offer care but care provided by child i would have been the parent's most preferred available alternative had child i offered care.

In our examples,

$$u_1 = \left[\frac{1}{3} + \frac{1}{6}(1-p_2)\right] V_{11} - \frac{1}{6}[1 + 2(1-p_2)] V_{10} - \frac{1}{6} p_2 V_{12}, \tag{6}$$

and u_2 has a symmetric form. The term multiplied by V_{11} is the probability that care provided by child 1 is the best alternative from the parent's perspective ($s_k = (1,0,2)$ or $s_k = (1,2,0)$) or that care provided by child 2 is the best alternative and care provided by child 1 is the next best alternative ($s_k = (2,1,0)$) and child 2 does not offer care; in either case, the parent would accept child 1's offer and child 1 would receive V_{11}. The term multiplied by V_{10} is the probability that care provided by child 1 is the best alternative and independence is the next best alternative ($s_k = (1,0,2)$) or that independence is the worst alternative ($s_k = (1,2,0)$ or $s_k = (2,1,0)$) and child 2 does not offer care; in either case, the parent would remain independent in the absence of an offer from child 1, and child 1 would receive V_{10}. The term multiplied by V_{12} is the probability that care provided by child 1 is the best alternative and care provided by child 2 is the next best alternative ($s_k = (1,2,0)$) and child 2 offers care; in this case, the parent would accept child 2's offer in the absence of an offer from child 1, and child 1 would receive V_{12}. If the parent would prefer remaining independent over receiving care from child 1 ($s_k = (0,1,2)$, $s_k = (0,2,1)$, or $s_k = (2,0,1)$), child 1's behavior has no impact on the outcome; thus, probabilities and outcomes associated with these preference rankings do not enter equation (6).

In general, equation (5) can be written as

$$u_i = a_{ii} V_{ii} + \sum_{j \neq i} a_{ij} V_{ij}. \tag{7}$$

Each family member $j \neq i$ computes $p_i = \Pr[u_i > 0]$ as

$$p_i \quad = \quad \Pr\left[a_{ii}\left(\bar{V}_{ii} + \varepsilon_{ii}\right) + \sum_{j \neq i} a_{ij}\left(\bar{V}_{ij} + \varepsilon_{ij}\right) > 0\right] \tag{8}$$

$$= \quad \Pr\left[a_{ii}\bar{V}_{ii} + \sum_{j \neq i} a_{ij}\bar{V}_{ij} > \eta_i\right]$$

where $-\eta_i = \sum\limits_j a_{ij}\varepsilon_{ij}$ is the random component of u_i in equation (7). Thus $\eta_i \sim \text{ind } N[0, \sigma_\varepsilon^2 a_i' a_i]$ where $a_i' = (a_{i0}, a_{i1}, a_{i2}, ..., a_{in+1})$, and

$$p_i = \Phi\left[\frac{a_{ii}\bar{V}_{ii} + \sum\limits_{j \neq i} a_{ij}\bar{V}_{ij}}{\sigma_\varepsilon\sqrt{a_i' a_i}}\right]. \tag{9}$$

In our examples,

$$p_1 \quad = \quad \Pr\left\{\left[\frac{1}{3} + \frac{1}{6}(1 - p_2)\right]V_{11} - \frac{1}{6}\left[1 + 2(1 - p_2)\right]V_{10} - \frac{1}{6}p_2 V_{12} > 0\right\} \tag{10}$$

$$= \quad \Phi\left[\frac{\left[\frac{1}{3} + \frac{1}{6}(1 - p_2)\right]\bar{V}_{11} - \frac{1}{6}p_2\bar{V}_{12}}{\left\{\left[\frac{1}{3} + \frac{1}{6}(1 - p_2)\right]^2 + \frac{1}{36}\left[1 + 2(1 - p_2)\right]^2 + \frac{1}{36}p_2^2\right\}^{1/2}}\right],$$

and p_2 has a symmetric form (note that $\bar{V}_{10} = 0$ and thus disappears from equation (10)). An equilibrium set of strategies is a set $p^* = (p_1^*, p_2^*, ..., p_n^*)$ such that if each family member $j \neq i$ believes that $p_i = p_i^*$ for all i, then each family member j offers care with probability p_j^* (with the realization depending upon the realization of ε_j). Figure 1 graphs p_1 as a function of p_2^* and p_2 as a function of p_1^* for each family in our examples.

If p^* is a vector of equilibrium probabilities, then $q_i = \Pr[i \text{ provides care}]$ is

$$q_i = p_i^* \sum_{j=1}^{n} \sum_{m_1=j+1}^{n+2} \sum_{\substack{m_2=j+1 \\ m_2 \neq m_1}}^{n+2} \sum_{\substack{k: s_{kj}=i \\ s_{km_1}=0 \\ s_{km_2}=n+1}} \left[\prod_{l=1}^{j-1}(1 - p_{s_{kl}}^*)\right] r_k \tag{11}$$

for $0 < i \leq n$,

$$q_0 = \sum_{j=1}^{n+1} \sum_{m=j+1}^{n+2} \sum_{\substack{k: s_{kj}=0 \\ s_{km}=n+1}} \left[\prod_{l=1}^{j-1}(1 - p_{s_{kl}}^*)\right] r_k, \tag{12}$$

and

$$q_{n+1} = \sum_{j=1}^{n+1} \sum_{m=j+1}^{n+2} \sum_{\substack{k: s_{kj}=n+1 \\ s_{km}=0}} \left[\prod_{l=1}^{j-1} (1 - p^*_{s_{kl}}) \right] r_k. \tag{13}$$

The intuition here is similar to that in computing u_i in equation (5); one sums the probabilities over all preference rankings where the relevant care arrangement is the parent's most preferred available alternative. In equation (11), one sums over j the probabilities that care provided by child i is the parent's jth most preferred alternative, that the children representing the first $j-1$ best alternatives from the parent's perspective offer no care, and that the parent prefers care provided by child i to continued independence and nursing home care. This is then multiplied by the probability that child i offers care. In equation (12), one sums over j the probabilities that independence is the jth best alternative, that the children representing the first $j-1$ best alternatives offer no care, and that continued independence is preferred to nursing home care. Equation (13) has an analogous form.

In our examples,

$$\begin{aligned} q_0 &= \frac{2}{6} + \frac{1}{6}\left[(1-p_1^*) + (1-p_2^*)\right] + \frac{2}{6}(1-p_1^*)(1-p_2^*) \\ q_1 &= \frac{2}{6}p_1^* + \frac{1}{6}(1-p_2^*)\,p_1^* \\ q_2 &= \frac{2}{6}p_2^* + \frac{1}{6}(1-p_1^*)\,p_2^*. \end{aligned} \tag{14}$$

The probability that the parent remains independent q_0 is the probability that independence is the best alternative from the parent's perspective, care provided by child 1 is the best alternative and independence is the next best alternative and child 1 does not offer care, care provided by child 2 is the best alternative and independence is the next best alternative and child 2 does not offer care, or independence is the worst alternative but neither child offers care. The probability that child 1 provides care q_1 is the probability that care provided by child 1 is the best alternative and child 1 offers care or that care provided by child 2 is the best alternative and care provided by child 1 is the next best alternative and child 1 offers care but child 2 does not. Note that the probability that child 2 provides care q_2 has a symmetric form.

In noncooperative game theoretic models, it is frequently the case that allowing for sidepayments among agents significantly expands the set of possible equilibria (e.g., Bernheim, Schleifer, and Summers 1985). We do not allow for sidepayments because they would require strategies that are too complicated to allow for equilibrium solutions. Also, the sidepayment data in the our sample is of poor quality and restricts our ability to identify the parameters of a model where sidepayments play a key role. Engers and Stern (1998) allow for sidepayments in a subgame of their model.

4 Econometric Methodology

In order to estimate the model, first we specify

$$\bar{V}_{ij} = X_0\beta + X_j\psi + Q_{ij}\alpha + e_{ij}. \tag{15}$$

The vector X_0 includes parental characteristics such as age, race, gender, education, and ADL indicators. For example, V_{i0}, the value to family member i of the outcome where the parent remains independent, may depend negatively on the number of ADL problems. For $0 < j \leq n$, the vector X_j includes characteristics of the jth alternative such as child j's gender, work status, and distance from the parent; thus, $X_j\psi$ measures the effect of child characteristics on the value to family members of care provided by that child. This may include a measure of the quality of care that child j provides and a measure of the burden that child j incurs (that is internalized by other family members). For example, a child living far away from the parent may provide inferior care or may incur a larger burden, all else equal; as a consequence, each family member may place a relatively low value on care provided by that child.[7] In general, we cannot identify altruistic concerns for the parent about the quality of care a particular child would provide from altruistic concerns for the child about the burden she would incur. For $j = n + 1$, the vector X_j includes characteristics of nursing homes. For example, a family living in a state with high income or asset hurdles for Medicaid nursing home financing may be more reluctant to use nursing home care than a family in a state with low hurdles, all else equal. The vector Q_{ij} includes differences in characteristics between family member i and alternative j (differences between siblings) such as differences in gender or marital status. The corresponding coefficients, β, ψ, and α, are the same for all family members because variation in these coefficients across family members would not be identified. Finally, e_{ij} represents unobserved characteristics affecting $\bar{V}_{ij}$.[8]

Equations (9) and (15) and the equilibrium condition determine the set of equilibrium care offer probabilities, $(p_1^*, p_2^*, ..., p_n^*)$. A Gauss-Seidel algorithm with progressive dampening is used to solve the equilibrium condition. In particular, let p^k be the kth step approximation of the vector of p's and a^k the corresponding matrix of a's implied by equations (5) and (7). Applying a^k to equation (9) provides a new approximation of p. We take a convex combination of the new approximation and p^k,

$$p^{k+1} = \omega p + (1 - \omega)p^k. \tag{16}$$

If $\omega = 1$, there is no dampening. We let ω decrease as k increases. Convergence is reached when the change in p is small. This method works very efficiently

[7] Engers and Stern (1998) add another term $X_j\gamma\delta_{ij}$ where $\delta_{ij} = 1\,(i = j)$ to distinguish between the effect of a child characteristic on a particular child's preferences and on all family member's preferences. We tried including such a term but could not estimate γ and ψ together with any precision.

[8] The specification of the error is the other difference in specification of $\overline{V}_{ij}$ between this paper and Engers and Stern (1998).

almost all of the time. Given the vector of care offer probabilities, the care probabilities q are determined in equations (11), (12), and (13).

The dependent variable for family m can be expressed as a vector Y_m where $Y_{mj} = 1$ if j is the chosen care alternative and $Y_{mj} = 0$ otherwise. Then $EY_m = q_m$, the vector of care probabilities. Let $y_m = Y_m - EY_m$ be the vector of residuals of family m, and let y be the residuals stacked by family. Let Z be a matrix of instruments, described in Stern (1995), that are needed because some child characteristics, in particular distance and work status, may be endogenous. Let the vector of parameters be $\theta = (\beta,\, \psi,\, \alpha,\, \sigma_\varepsilon^2,\, \sigma_e^2)$ where $\sigma_e^2 = Ee_{ij}^2$. Then the instrumental variables estimator of θ is

$$\hat{\theta} = \operatorname*{argmin}_{\theta} y'ZZ'y. \tag{17}$$

If there were no potential endogeneity problems, then the instruments would be $\partial \log EY_m / \partial\theta$. However, work status and distance of the child may be endogenous; the chosen caregiver may change her work status or move closer to the parent. We control for endogeneity by using the 1982 work status and distance in evaluating $\partial \log EY_m / \partial\theta$. People living independently in 1982 were very likely to live independently in all relevant years prior to 1982 (see Stern, 1995). Since we limit the sample to parents who live independently in 1982, there is no variation in the dependent variable in 1982 or any relevant year prior to it. Thus, instruments cannot be correlated with the lagged dependent variable. Conditioning on the parent living independently in 1982 alters the distribution of any unobservables in 1984. However, in a similar model, Stern (1994) shows that, though theoretically relevant, the problem is not empirically important. Finally, a second order expansion of EY_m shows that the instruments will be correlated with the residuals used in equation (17) because EY_m is a nonlinear function of the endogenous regressors.[9] We performed a Monte Carlo study to measure the size of the bias caused by this problem. For this application, the simulated biases are very small and statistically insignificant because the instruments are very good predictors of the endogenous regressors.

We use a bootstrapping procedure to estimate the covariance matrix of the instrumental variables estimator of θ. In particular, conditional on $\hat{\theta}$, we simulate forty independent samples of data generated by the model. For each one, we estimate θ, and then we estimate the sample covariance matrix of the estimated θ's. We also can use this procedure to test for small sample bias.

In order to verify the identification of the parameters in θ, consider temporarily a simpler model where care probabilities depend only on

$$V_j^T = \sum_i V_{ij} = nX_0\beta + nX_j\psi + \sum_i Q_{ij}\alpha. \tag{18}$$

As in multinomial logit, all terms are identified except for a base β_j. Other researchers have tried to measure the effect of family size on care choices by including n as a linear explanatory variable. Note that in equation (18), family

[9] We thank Tom Mroz for patiently explaining this to us.

size affects choices in that it affects the number of options and it affects the value of each option; it is not linear. The extra assumptions needed once we consider the more complicated model in section 3 is that $\partial p/\partial \mathrm{vec}V$ and $\partial q/\partial p$ are each full rank. This can be verified at the estimate of θ.

5 Results

5.1 Parameter Estimates

The explanatory variables in the model fall into four categories: characteristics of the parent, characteristics of the children, measures of the relationship between children, and policy variables. The parental characteristics included in the model are gender (FEMALE), age (AGE), educational attainment (EDUC), marital status (MARRY), race (BLACK), and a set of dummy variables that represent problems with activities of daily life: getting out of bed (ADBED), bathing (ADBTH), dressing (ADDRS), eating (ADEAT), using a toilet (ADTLT), and walking inside (ADWKI). One might consider respecifying our model so that $\overline{V}_{ij}$ depends only on the number of ADL's. However, the null hypothesis that all of the ADL variables have equal effects can be rejected at the 10% level ($\chi^2_5 = 9.36$). Moreover, Engers and Stern (1998) reject the same null hypothesis with a χ^2_5 value of 436.2, and Stern (1995) rejects it with a χ^2_5 value of 18.4 (which are both significant at the 1% level). Unfortunately, the model does not include any measures of the parent's financial status because the NLTCS includes only unreliable income and asset data (Stern, 1995).

The policy variables involve Medicaid program characteristics that vary by the parent's state of residence. The variable PROGRAM indicates whether the state has a "medically needy" program. In the presence of such a program, individuals may deduct medical costs from income in determining eligibility for Medicaid; thus, in such states, many middle-class individuals are eligible for Medicaid coverage of nursing home care. The variables RESLIM and INCLIM represent, respectively, the state's countable resource (asset) and whether the state has an income limit for Medicaid eligibility.

The child characteristics included in the model are gender (FEMALE), age (AGE), marital status (MARRY), distance from the parent (DISTi, i =1, 2,..., 5), employment status (WORK), spouse's employment status (SWORK), number of children (CHILD), and dummies for the oldest male child (OMC) and the oldest female child (OFC). Ideally, the model would also include variables indicating the children's incomes and the sizes of their homes. But such information is not available in the NLTCS.

The model also includes variables that represent differences between children to capture the idiosyncratic relationships between children. The idiosyncratic relationship between a pair of children is measured in terms of the absolute value of their age difference (AGE), the minimum (MINDIST) and maximum (MAXDIST) possible distances between them,[10] whether the two children are

[10] We observe the distance between each child and the parent but not the distances between

of the opposite gender (SEX), whether they have different marital statuses (MARRY), whether they have different employment statuses (WORK), and whether child j is older than child i (AGE0).

The normalization of V_{ij} (the value to individual i of outcome j) varies across categories of variables. The outcome where the parent receives care from a child is the base case for the parental characteristics other than activity of daily life problems. Thus, we allow parental characteristics such as gender, age, and marital status to have different effects on preferences for all three categories of outcomes (independent living, care from a child, and nursing home care). On the other hand, problems with activities of daily life most directly affect the parent's ability to live independently; thus, we measure the effect of ADLs on living independently relative to all of the other alternatives.[11] Since characteristics of a particular child and relationships between children are unlikely to affect family members' relative valuations of nursing home care and independent living, the effects of these characteristics are normalized to zero for both outcomes that do not involve care from a child. Similarly, the generosity of a state's Medicaid program is unlikely to affect family members' relative valuations of the outcomes that do not involve nursing home care. Thus, the effects of policy variables are normalized to zero for the outcomes where the parent lives independently and where the parent receives care from a child .

Table 2 displays the parameter estimates and the estimated standard errors. An I-prefix on a parental characteristic indicates that the corresponding coefficient measures the effect of the characteristic on the value to each family member of the outcome where the parent lives independently. Similarly, an N-prefix on a parental characteristic or a policy variable signifies that the coefficient measures the variable's effect on the value to each family member of the outcome where the parent lives in a nursing home. The child characteristics have CF-prefixes, indicating that the coefficient measures the effect of the characteristic on the value to each family member of the outcome where a child with that characteristic provides care. The child difference variables have CD-prefixes. These coefficients measure the effect of the relationship between children i and j on the value to child i of the outcome where child j cares for the parent.

The results suggest that families' long-term care decisions depend on parental and child characteristics. In contrast to Pezzin and Schone (1996) who find that daughters[12] are more likely to care for fathers than for mothers, our results suggest that care provided by children is valued more highly for mothers than for fathers, all else equal (I-FEMALE < 0, N-FEMALE < 0). Consistent with previous studies (Kotlikoff and Morris, 1990; Hoerger, Picone, and Sloan, 1996; Pezzin and Schone, 1996, 1997; Sloan, Picone, and Hoerger, 1997), our results indicate that independence is valued more highly for married parents

children. Given the information on each child's distance from the parent, we can construct MINDIST and MAXDIST as proxies for the true distance between the two children.

[11] Some prelimary multinomial logit regressions associated with Stern (1995) suggest that the parameters measuring the differential effect of ADL's on the value of nursing home care to care by children is insignificant.

[12] All of the children in Pezzin and Schone (1996) are daughters.

(I-MARRY > 0), while institutional care is valued more highly for unmarried parents (N-MARRY < 0). We also find evidence that family members' valuation of institutional care depends positively on the parent's age and educational attainment (N-EDUC > 0, N-AGE > 0). The effect of parental education may partially reflect income effects because the model does not include a measure of parental income. If so, this result is surprising in light of evidence that higher income is associated with increased independence (Hoerger, Picone, and Sloan, 1996; Pezzin and Schone, 1996). Contrary to expectations, only one ADL problem significantly decreases the value to family members of the outcome where the parent lives independently (I-ADBTH<0). Studies that measure parental disability in terms of the number of ADL or IADL limitations (Hoerger, Picone, and Sloan, 1996; Pezzin and Schone, 1996, 1997; Sloan, Picone, and Hoerger, 1997) typically find significant effects of these variables, but parental health, as measured by a set of dummy variables, is generally insignificant in Kotlikoff and Morris (1990).

Controlling for other parental and child characteristics, we find that, all else equal, children who live close to their parents are valued more highly as care providers (CF-DISTi approximately increases in absolute value in i). Also, on average, daughters are valued more highly as care providers than are sons (CF-FEMALE>0). This result is consistent with previous studies. For example, Kotlikoff and Morris (1990) report that parents are more likely to live with a daughter than with a son, and Sloan, Picone, and Hoerger (1997) report that daughters are more likely to care for elderly parents. Also, the value to child i of the outcome where child j provides care is greater if children i and j differ in terms of gender (CD-SEX>0). Thus, our results suggest that women prefer outcomes where their brothers provide care than outcomes where their sisters provide care and vice versa. The CD-SEX and CF-FEMALE coefficients together imply that, while children prefer caregivers of the opposite gender, brothers have a stronger preference for sisters than sisters do for brothers. Likewise, adult children place more value on the care provided by siblings with lifestyles that differ from their own (CD-MARRY>0, CD-WORK>0). Perhaps children feel guilty not caring for an elderly, functionally impaired parent, particularly if a sibling with similar characteristics or a similar lifestyle cares for the parent. Perhaps the reason why the CD-variable coefficients are large is that the major variation in the $\bar{V}$-matrices over family members is due to variation in the CD-variables and thus they need to explain much of the variation in observed choices.

The policy variable results are disappointing; none of these variables is significant, and only the income limit variable (N-INCLIM) has the expected sign. This result may occur because a high proportion of nursing home stays is financed privately so that Medicaid nursing home financing policy may not be relevant. It may also occur because many families have devised ways to get around the rules. The real problem here is that we have a poor measure of Medicaid eligibility because the income and wealth data in the NLTCS are not of high enough quality to use here. Cutler and Sheiner (1993), using the same data source, get significant estimates of the effect of Medicaid financing rules on demand. But, they do so by using the income and wealth data that we thought were of low enough quality to avoid using.[13] Thus, the solution is to develop data sets with good information on each family member and with good information on income and wealth. Hoerger, Picone, and Sloan (1996) report significant effects of several policy variables on living arrangements of the elderly: direct subsidies for nursing home care, state policies limiting nursing home beds or reimbursement, and state policies subsidizing community living. In addition, Pezzin and Schone's (1996, 1997) policy simulations reveal strong effects of a publicly provided universal home care program on living and care arrangements for the elderly.

5.2 Comparative Statics

The comparative statics presented in Table 3 provide insight on the magnitude of the estimated effects. Each of these tables indicates the probabilities of the various outcomes for a base case and for a series of changes in parental, child, and policy characteristics. For all base cases, the parent is an eighty-year old, white female with 12 years of education. She has no ADL problems and lives in a state without a medically needy program. All of the children are married and employed and live between 11 and 30 minutes from the parent (DIST2). The oldest child (child 1) is 55 years old, and successive children are two years apart. Odd children are female, while even children are male. The tables differ with regard to family size and the parent's marital status. Tables 3A and 3B apply to families with two children, while Tables 3C and 3D apply to families with four children. Tables 3A and 3C involve unmarried parents, while Tables 3B and 3D involve married parents.

For example, the first row of Table 3A indicates the probabilities associated with each outcome for families with two children, an unmarried parent, and other base case characteristics. In such families, the parent (a mother) faces a 75% chance of living independently, a 24% chance of receiving care from one of her children (a 15% chance of receiving care from the older child and a 9% chance of receiving care from the younger child), and a 2% chance of receiving institutional care. As shown in the first row of Table 3B, a married mother in an otherwise identical family faces an 92% chance of living independently, an 8% chance of receiving care from one of her children, and almost no chance of receiving institutional care.

The first rows of Tables 3C and 3D provide analogous information for women with base case characteristics and four children. The tables indicate that, for such families, the probability that the mother lives independently is 58% if she is unmarried and 85% if she is married, the probability that she receives care from a child is 37% if she is unmarried and 13% if she is married, and the probability that she receives institutional care is 5% if she is unmarried and 2%

[13] The other significant difference between Cutler and Sheiner and work in Stern (1995), Engers and Stern (1998) and this paper is that Cutler and Sheiner aggregate the children into one choice and therefore do not control for characteristics of each child and do not have the endogenous child characteristics problem we have.

if she is married. Thus, all else equal, unmarried mothers are about three times more likely to receive care from a child than are married mothers. The chance that the mother receives institutional care is also several times greater if she is unmarried than if she is married.

Holding constant all other factors including marital status, the chance that a parent receives care from a child and the chance that a parent receives institutional care depend positively on the number of children in the family. The second rows of Table 3 indicate that, like mothers, fathers are more likely to receive care of either type if they are unmarried or if they have a large family. Although marital status and family size have the same qualitative effects for mothers and for fathers, the parent's gender influences the probabilities of the various outcomes. Relative to mothers, fathers are more likely to remain independent, less likely to receive care from a child, and more likely to receive institutional care for all four of the cases displayed in Table 3.

The effects of the children's genders are particularly striking. As illustrated in Tables 3A and 3B, parents with base case characteristics and two children face considerably higher chances of receiving care from a child (and considerably lower chances of living independently) if both children are daughters than if one or both children are sons. In the case of an unmarried parent, for example, if both children are female, the chance that the parent receives care from a child is 51% compared to 24% if only the first child is female, 31% if only the second child is female, and 25% if both children are male. Tables 3C and 3D reveal similar patterns regarding the effects of the children's genders.

Although only one ADL problem has a statistically significant effect on family members' preferences, giving the parent a problem getting out of bed, bathing, dressing, or eating has a relatively large negative impact on the probability that the parent lives independently for all four cases displayed in Table 3.

5.3 Specification Tests

We conduct several chi-squared goodness-of-fit tests to determine whether the model is correctly specified. Let $\tilde{y}$ be a particular vector of residuals (it may be different than y in equation (4.3)) with k elements and $\tilde{\Omega}$ be the covariance matrix of $\tilde{y}$. Then the goodness-of-fit statistic is $\tilde{y}'\tilde{\Omega}^{-1}\tilde{y} \sim \chi^2_k$. The test statistic for families of size n can be written as $\sum\limits_{m=1}^{N_n} \tilde{y}_m'\tilde{\Omega}_m^{-1}\tilde{y}_m$ where m indexes the N_n families of size n.[14] In our test statistics, some of the elements of $\tilde{y}$ are outliers thus inflating the statistic. In those cases, in order to measure whether rejection is due to a few outliers or to overall inconsistency with the model, we censor $\tilde{y}_m'\tilde{\Omega}_m^{-1}\tilde{y}_m$ at the $.001\chi^2_{n-1}$ level for each $m = 1, 2, .., N_n$ and each n in the spirit of Huber's (1981) M-estimators. Technically, we must reject the model overall. But it is clear that this occurs only because the model fits a small number of

[14] Note that $k = \sum_m (n-1)N_n$. Also note that $\tilde{\Omega}$ is block diagonal with $\tilde{\Omega}_m$ being the mth block for $m = 1, 2, .., N_n$.

observations very poorly.

In the first specification test, we let $\tilde{y}$ be the vector of residuals in equation (17); this is an overall test for goodness-of-fit. The uncensored statistic with 4600 degrees of freedom is .265E+13 which is highly statistically significant. The test statistics conditional on family size are also all very significant except for families with no children. However, when the censoring procedure is used to diminish the effect of outliers, the overall test statistic and all of the test statistics specific to family size become very insignificant.[15] We disaggregated the test statistic by parent's state of residence as well to look for state effects. There are a few states with very large statistics, but the sum of censored statistics is not significant.

We also conduct two sets of specification tests using data on families who were excluded from our sample, namely 723 families in which the parent received care from a child in 1982 and 36 families with imputed values for some of the variables used in our model where the imputation method involved a significant guess. The uncensored and censored χ^2 statistics are significant for the 723 families receiving care from a child in 1982 probably because the care probabilities estimated in the model should be interpreted as conditional on not receiving care in 1982. In other words, 1984 care transition probabilities depend upon the care state the family is starting from in 1982. This point is made in Stern (1995) and Engers and Stern (1998). The 36 families with uncertain imputed values reject the model using the uncensored χ^2 statistic but do not reject it using the censored χ^2 statistic.

One might worry that families with married elderly parents would behave differently than families with single parents in ways that cannot be captured by a single dummy variable as in Table 2. In particular, one might worry about interaction effects of parental marital status and other explanatory variables. It is very costly to include a full set of interaction effects in the estimation procedure. However we can easily construct a Lagrange multiplier-like χ^2 test. Let $\tilde{y}_M$ be a vector of residuals for only observations where the parent is married, and let $\widetilde{q}_M = X_M' \tilde{y}_M$ be an orthogonality condition applied only to married observations. If all married effects are captured by a constant, then

$$\widetilde{q}_M' \widehat{D}^{-1} \left(\widetilde{q}_M\right) \widetilde{q}_M \sim \chi_k^2$$

where $\widehat{D}^{-1} \left(\widetilde{q}_M\right)$ is an estimate of the inverse of the covariance matrix of $\widetilde{q}_M$ and k is the number of explanatory variables included in X. For the parent variables, the χ_{19}^2 is 3.85 (which is not significant), for the CF variables, the χ_{13}^2 is 1133458.2 (which is very significant), and for the CD variables, the χ_7^2 is $0.58 \cdot 10^{10}$ (which is very significant). This suggests that marital status does not interact with other parent characteristics but may interact with other child characteristics. We have some skepticism about the size of the child interaction

[15] Note that $\zeta_j = \left(\chi_j^2 - j\right) / \sqrt{2j} \sim N(0,1)$; the test is a one-sided test with only large positive values of ζ_j implying rejection. For the censored statistics, ζ_1 =-7.46, ζ_2 =-7.24, ζ_3 =-9.69, ζ_4 =-9.87, and ζ_5 =-7.51.

χ^2 statistics because they are caused almost entirely by interaction of CF-DIST5 and CD-WORK which are both measured with pretty large standard deviations.

The model seems to explain the behavior of most families reasonably well without any evidence of obvious family size effects or state effects. The goodness-of-fit statistics suggest that dynamics are important in that transition probabilities among care alternatives depend upon the family's previous care decision. Once a few outliers are censored, the model is consistent with the data.

6 Welfare Analysis

The mechanism used to make long-term care decisions influences the selected care arrangement and, as a result, family members' utility levels. Thus, we compare family utility levels for four different decision-making mechanisms: our strategic model (STRATEG), a family utility maximization model where an omniscient social planner selects the outcome which maximizes the sum of family members' utility levels (UTILIT), a limited family utility maximization model where the social planner cannot observe error terms (LIMITED UTILIT), and an autarchic model where children cannot care for the parent (AUTARC).[16] For R =10,000 independent draws of the errors, we determine each family's decision and each family member's expected utility level corresponding to each of the four models. Let u^r_{mi} be the utility of family member i in family m given the rth draw of the errors. Let $\bar{u}_{mi} = \frac{1}{R}\sum u^r_{mi}$, $\sigma^2_{umi} = \frac{1}{R}\sum\left(u^r_{mi} - \bar{u}_{mi}\right)^2$, and $\bar{u}_m = \frac{1}{n_m+1}\sum\limits_{i=0}^{n_m}\bar{u}_{mi}$ where n_m is the number of children in family m. Table 4 reports, by family size, mean family utility levels for each model (the average $\bar{u}_m$) and the standard deviations of these means. Also by family size and by model, the table shows the average (over all individuals) standard deviation of individual utility levels (the average σ^2_{umi}).

Relative to strategic play, the presence of either an omniscient or a limited social planner improves the well-being of the average child. An omniscient social planner decreases the well-being of the average parent in families with at least two children, while a limited social planner decreases the well-being of the average parent in families of all sizes. Moreover, as family size increases, the impact of a social planner on the utility levels of children and parents tends to increase. In large families, the utility of the average child and overall family utility are considerably higher if a social planner, whether omniscient or limited, intervenes than if the family members interact strategically. One might wonder why the family cannot achieve the social planner's equilibrium and might suggest that it is due to our restriction on side payments. We do not allow for sidepayments partially because it makes the equilibrium too difficult to solve and partially because there is some evidence that sidepayments (at least financial sidepayments) play a small role in family decision making. But, as shown

[16] Since strategic play and care provided by a child are relevant only in families of size two or larger, the models based on strategic play, autarchy, and an omniscient social planner are equivalent in families of size one.

in Engers and Stern (1998), the existence of sidepayments does not guarantee a Pareto optimal equilibrium.[17]

Not surprisingly, preventing children from caring for the parent decreases the well-being of the average parent relative to the case of strategic play. As the number of children and thus the number of potential offers increases, parents benefit more from allowing children to provide care. The effect of autarchy on children's well-being is unclear.

For each family size, Table 4 also indicates the probability that the family, when playing strategically, chooses the outcome that maximizes family utility and the probability that the family chooses the outcome that generates the second highest family utility. As family size increases, the chance of choosing the best outcome decreases.

The "collective model" in Engers and Stern (1998) is a simple model where all of the family members come together and choose the care alternative that maximizes V_j^T in equation (18). Thus, by assumption, the probability that the family chooses the outcome that maximizes family utility is one. It is highly likely, therefore, that that model will have different policy implications than the one in this paper. Yet, the data are not rich enough to identify the true structure of the bargaining game. So one should be quite cautious about drawing welfare implications from these models. An alternative might be to use a less structured model such as Cutler and Sheiner (1993) or Stern (1995). But the lack of structure essentially means that the true structure is not identified. Since the true structure still has important policy implications, one should be just as cautious about using results from these less structured models. In fact, a large benefit of the structural model results is that they imply serious limitations of using any less structural model to perform policy analysis; one would not have known this without estimating a number of different structural models.

7 Conclusions

We have presented a game-theoretic model of family decision making. The model leads to reasonable estimates of the marginal effects of various parent and child characteristics on caregiving behavior. In particular, it predicts that mothers are more likely than fathers to be cared for by children, married parents are more likely than single parents to live independently, daughters are more likely than sons to care for parents, and family members' valuation of care provided by a child depends negatively on the distance between the parent and the child. Once we control for the influence of outliers in the specification tests, the model is consistent with the data. Disappointing results concern the lack of significance of ADLs and Medicaid variables in predicting care decisions.

The estimated model suggests that there are significant gains to family utility by encouraging children to provide care for parents. An omniscient social planner can perform considerably better than the family members do in the

[17] Examples of sidepayment rules that do not lead to Pareto optimal decisions are rules that "split rents" evenly or rules based on the Shapley value.

specified noncooperative game. Even a social planner limited to a more reasonable information set performs reasonably well relative to family members playing strategically in families with at least two children.

This paper presents a particular model of family decision making, Engers and Stern (1998) present two other models, and Stern (1995) presents yet a fourth model. All four provide reasonable results. But none explains the data significantly better than the others. It appears that the data are not rich enough to (empirically) identify the various models. On the one hand, the results suggest that only substantively richer data can give us good information about how families make caregiving decisions. It is not obvious what that richer data should be. Recent work such as Browning et al. (1994) has developed ways to tease a limited set of characteristics of family decision making out of consumption data. But there is no obvious analog to joint consumption in the case of families split up into separate households with separate budget constraints. Bargaining theory provides little help also. The experimental literature on bargaining (see Roth 1995) focuses on how agents play in well specified games rather than what the games look like. One might conduct a survey with some open-ended questions as in Allen, Hogg, and Peace (1992). But, even then, it is difficult to interpret statements respondents made. For example, one caregiver said, "I'd have liked everyone concerned to have got together and talked but they never did...I felt if we all got together for a few hours and discussed his needs and who could do what...."[18] One can interpret this as evidence of a decision-making mechanism not involving a family meeting with voluntary participation as in Engers and Stern (1998). However, one also can interpret this as an example of the existence of such a family meeting where no one but the respondent and the parent participated. We doubt one can ask questions that elicit good information from respondents directly about the decision making process. Possibly other information such as good sidepayments data or better data about relationships among family members might significantly help in evaluating models.

On the other hand, the results suggest that a number of empirical regularities are quite robust to the particular structural specification of the model. It is possible that, while those regularities are robust, other implications of the model (e.g., efficiency and distributional implications) vary. The advantage of this modelling approach over less structural approaches is that we can test for such variation once we have structural parameters; such an exercise with a less structural model would be infeasible. We do not do so here because, as yet, we are not convinced that Medicaid financing rules are irrelevant. As discussed earlier, the poor data on income and wealth prevent us from measuring Medicaid eligibility. If it occurs at some point that welfare results are sensitive to model structure, then that implies that less structural models are not appropriate for welfare analysis because the relevant characteristics of the (underspecified) model were not estimated. If, on the other hand, it occurs that welfare results are not sensitive to model structure, then any of the structural models can be

[18] Allen, Hogg and Peace (1992), p. 131.

used for welfare analysis and policy experiments. Of course, a prerequisite to resolution of this issue is data that allow us to identify Medicaid financing rule effects.

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Table 1
Sample Moments for 1984 Data

Parent Variables			
Variable	Definition	Mean	St. Dev.
	Receiving Care from a Child	0.155	0.362
	Living in Nursing Home	0.086	0.281
	Living Independently	0.759	0.428
FEMALE	Female	0.619	0.486
AGE	Age	77.35	6.96
EDUC	Education	9.33	3.79
MARRY	Married	0.510	0.500
BLACK	Black	0.098	0.298
ADBED	ADL Problem - Bed	0.172	0.377
ADBTH	ADL Problem - Bathing	0.320	0.467
ADDRS	ADL Problem - Dressing	0.201	0.401
ADEAT	ADL Problem - Eating	0.091	0.288
ADTLT	ADL Problem - Toilet	0.156	0.363
ADWKI	ADL Problem - Walking Inside	0.156	0.363
PROGRAM	State has a Medically Needy Program	0.497	0.500
RESLIM	State Countable Resource Limit/100	19.352	5.306
INCLIM	Whether State has an Income Limit	0.37	0.48
	Number of Children	1.424	
Child Variables			
Variable	Definition	Mean	St. Dev.
FEMALE	Female	0.460	0.498
AGE	Age	44.89	13.60
MARRY	Married	0.832	0.375
DIST1	Distance from Parent Dummy 1	0.181	0.385
DIST2	Distance from Parent Dummy 2	0.185	0.388
DIST3	Distance from Parent Dummy 3	0.097	0.296
DIST4	Distance from Parent Dummy 4	0.295	0.456
DIST5	Distance from Parent Dummy 5	0.151	0.358
WORK	Child Works	0.668	0.471
SWORK	Child's Spouse Works	0.593	0.491
CHILD	Number of Child's Children	0.684	1.079

Notes:

1. Sample size is 1952.
2. The PROGRAM variable is from Cutler and Sheiner (1993), Table 3, Column 1.

3. The RESLIM variable and the INCLIM variable are from Neuschler and Gill (1986), Table 1, Pg. 11.

4. Distance dummies for children are 0 = living with parent (base choice), 1 = 1 to 10 minutes, 2 = 11 to 30 minutes, 3 = 31 to 60 minutes, 4 = 61 minutes to less than 1 day, and 5 = greater than or equal to 1 day.

5. Reported SWORK moments are conditional on a spouse being present.

Table 2
Coefficient Estimates

Variable	Value	Variable	Value	Variable	Value
N-CONST	-2.415** (0.079)	N-BLACK	-0.169 (0.705)	N-INCLIM	-0.016 (0.158)
I-CONST	-0.740** (0.120)	I-BLACK	0.353 (0.765)	CF-FEMALE	0.592** (0.181)
N-FEMALE	-0.542** (0.087)	I-ADBED	-0.432 (0.526)	CF-AGE	0.003 (0.009)
I-FEMALE	-0.294** (0.130)	I-ADBTH	-0.653** (0.279)	CF-MARRY	-0.046 (0.194)
N-AGE	0.025* (0.013)	I-ADDRS	-0.437 (0.377)	CF-DIST=1	-1.018** (0.316)
I-AGE	-0.012 (0.017)	I-ADEAT	-1.009 (1.613)	CF-DIST=2	-1.621** (0.762)
N-EDUC	0.043** (0.016)	I-ADTLT	-0.015 (0.574)	CF-DIST=3	-1.501** (0.349)
I-EDUC	0.039 (0.023)	I-ADWKI	0.221 (0.162)	CF-DIST=4	-3.267** (0.741)
N-MARRY	-0.376** (0.178)	N-PROGRAM	-0.088 (0.081)	CF-DIST=5	-7.688** (1.330)
I-MARRY	0.830** (0.211)	N-RESLIM	0.005 (0.034)	CF-WORK	-0.100 (0.205)

Table 2 (continued)

Variable	Value	Variable	Value	Variable	Value
CF-SWORK	0.059	CD-SEX	6.821**	CD-MINDIST	-2.789
	(0.190)		(1.426)		(1.511)
CF-CHILD	0.035	CD-AGE	0.921	CD-MAXDIST	-3.164
	(0.059)		(1.261)		(2.110)
CF-OMC	0.232	CD-AGE0	-3.002	CD-WORK	42.396**
	(0.241)		(2.035)		(2.116)
CF-OFC	-0.025	CD-MARRY	2.994**		
	(0.254)		(1.354)		

Notes:

1. Variables are defined in Table 1. Coefficient names starting with I- are for home independently, coefficient names starting with N- are for nursing home, coefficient names starting with CF- are for child family effects, and coefficient names starting with CD- are child difference effects.

2. Parent age is differenced from 80, and parent education is differenced from 12.

3. CD-SEX = 1 iff genders of two children are different, CD-AGE is absolute value of difference of ages, CD-AGEO = 1 iff child i is older than child j, CD-MARRY = 1 iff two children have different marital statuses, CD-MINDIST is minimum possible distance between two children, CD-MAXDIST is maximum possible distance between children, and CD-WORK = 1 iff work statuses of two children are different.

4. Numbers in parentheses are asymptotic standard errors. Double starred items are significant at the 5% level, and single starred items are significant at the 10% level.

Table 3
Comparative Statics
A. A Family with 2 Children and Single Parent

Case	Probabilities			
	Live Independently	Child 1	Child 2	Institutional Care
BASE	.7476	.1488	.0884	.0152
PAR SEX	.8051	.1119	.0606	.0225
PAR AGE	.7298	.1561	.0953	.0188
PAR EDUC	.7215	.1620	.1021	.0145
PAR RACE	.8327	.1034	.0553	.0087
ADBED	.6400	.1860	.1513	.0227
ADBTH	.5899	.1680	.2143	.0277
ADDRS	.6390	.1861	.1522	.0227
ADEAT	.4954	.0543	.4136	.0367
ADTLT	.7439	.1506	.0901	.0154
ADWKI	.8010	.1201	.0666	.0123
PAR MNP	.7495	.1486	.0883	.0136
CH1 SEX	.7357	.0858	.1635	.0150
CH1 AGE	.7629	.1483	.0732	.0155
CH1 MAR	.7611	.16541	.0580	.0155
CH1 DST0	.2367	.7575	.0012	.0048
CH1 DST1	.5782	.3795	.0306	.0118
CH1 DST3	.6911	.1923	.1025	.0141
CH1 DST4	.6000	.0644	.3234	.0122
CH1 DST5	.8404	.0001	.1424	.0171
CH1 WRK	.7283	.2569	.0000	.0148
CH2 SEX	.4760	.1646	.3497	.0097
CH2 AGE	.7372	.1808	.0670	.0150
CH2 MAR	.7717	.1378	.0748	.0157
CH2 DST0	.3307	.0006	.6620	.0067
CH2 DST1	.6655	.0433	.2776	.0135
CH2 DST3	.7048	.1447	.1362	.0143
CH2 DST4	.5535	.3969	.0384	.0113
CH2 DST5	.7549	.2296	.0002	.0153
CH2 WRK	.7578	.2268	.0000	.0154
CH2 SEX	.6775	.0117	.2970	.0138

B. A Family with 2 Children and Married Parent

Case	Probabilities			
	Live Independently	Child 1	Child 2	Institutional Care
BASE	.9183	.0520	.0257	.0040
PAR SEX	.9485	.0312	.0146	.0056
PAR AGE	.9092	.0573	.0286	.0050
PAR EDUC	.9022	.0625	.0315	.0038
PAR RACE	.9573	.0277	.0129	.0021
ADBED	.8442	.0977	.0517	.0064
ADBTH	.7965	.1251	.0705	.0080
ADDRS	.8433	.0983	.0520	.0064
ADEAT	.7108	.1680	.1100	.0112
ADTLT	.9162	.0533	.0264	.0040
ADWKI	.9446	.0355	.0169	.0031
PAR MNP	.9188	.0520	.0256	.0036
CH1 SEX	.9449	.0180	.0330	.0041
CH1 AGE	.9211	.0515	.0234	.0040
CH1 MAR	.9192	.0552	.0216	.0040
CH1 DST0	.5088	.4870	.0020	.0022
CH1 DST1	.8282	.1520	.0162	.0036
CH1 DST3	.8996	.0685	.0280	.0039
CH1 DST4	.9581	.0035	.0343	.0041
CH1 DST5	.9648	.0000	.0310	.0042
CH1 WRK	.9240	.0716	.0004	.0040
CH2 SEX	.8310	.0580	.1074	.0036
CH2 AGE	.9171	.0549	.0241	.0040
CH2 MAR	.9220	.0491	.0249	.0040
CH2 DST0	.6277	.0032	.3664	.0027
CH2 DST1	.8740	.0356	.0866	.0038
CH2 DST3	.9062	.0528	.0371	.0039
CH2 DST4	.9261	.0663	.0036	.0040
CH2 DST5	.9351	.0609	.0000	.0040
CH2 WRK	.9379	.0564	.0016	.0041
CH2 SEX	.8944	.0091	.0926	.0039

C. A Family with 4 Children and Single Parent

Case	Probabilities					
	Live Independently	Child 1	Child 2	Child 3	Child 4	Institutional Care
BASE	.5826	.1288	.0163	.2106	.0122	.0494
PAR SEX	.6558	.0932	.0213	.1393	.0140	.0765
PAR AGE	.5518	.1363	.0144	.2271	.0112	.0593
PAR EDUC	.5434	.1437	.0128	.2443	.0104	.0454
PAR RACE	.7181	.0864	.0226	.1270	.0147	.0312
ADBED	.4145	.1742	.0050	.3391	.0059	.0613
ADBTH	.3397	.1839	.0022	.4037	.0040	.0666
ADDRS	.4129	.1745	.0049	.3404	.0059	.0614
ADEAT	.2410	.1814	.0006	.4999	.0026	.0746
ADTLT	.5767	.1307	.0159	.2148	.0120	.0499
ADWKI	.6658	.1011	.0214	.1546	.0145	.0425
PAR MNP	.5875	.1287	.0165	.2104	.0124	.0446
CH1 SEX	.6619	.0270	.0693	.1235	.0622	.0562
CH1 AGE	.6303	.0901	.0241	.1823	.0198	.0535
CH1 MAR	.6474	.0746	.0280	.1712	.0239	.0549
CH1 DST0	.2071	.7033	.0003	.0717	.0000	.0176
CH1 DST1	.4547	.3151	.0044	.1860	.0012	.0386
CH1 DST3	.4402	.2354	.0049	.2794	.0027	.0374
CH1 DST4	.4528	.0486	.0233	.3862	.0506	.0384
CH1 DST5	.6764	.0003	.0540	.1546	.0573	.0574
CH1 WRK	.6789	.0000	.0538	.1532	.0565	.0576
CH2 SEX	.3552	.0960	.2721	.2463	.0002	.0301
CH2 AGE	.5793	.1382	.0062	.2171	.0101	.0492
CH2 MAR	.5808	.1379	.0029	.2190	.0102	.0493
CH2 DST0	.2921	.0001	.6445	.0035	.0350	.0248
CH2 DST1	.5930	.0667	.1194	.1379	.0327	.0503
CH2 DST3	.5692	.1037	.0642	.1929	.0217	.0483
CH2 DST4	.4154	.1874	.0288	.3245	.0086	.0353
CH2 DST5	.5766	.1411	.0001	.2236	.0096	.0489
CH2 WRK	.5784	.1406	.0000	.2223	.0096	.0491
CH2 SEX	.4425	.0000	.2573	.2606	.0020	.0376

D. A Family with 4 Children and Married Parent

Case		Probabilities				
	Live Independently	Child 1	Child 2	Child 3	Child 4	Institutional Care
BASE	.8536	.0456	.0170	.0584	.0100	.0154
PAR SEX	.8973	.0285	.0114	.0341	.0065	.0223
PAR AGE	.8373	.0497	.0182	.0648	.0109	.0192
PAR EDUC	.8297	.0537	.0193	.0710	.0116	.0148
PAR RACE	.9201	.0254	.0102	.0300	.0058	.0085
ADBED	.7395	.0817	.0226	.1183	.0146	.0233
ADBTH	.6667	.1059	.0211	.1639	.0146	.0278
ADDRS	.7382	.0821	.0226	.1191	.0146	.0234
ADEAT	.5308	.1508	.0114	.2622	.0098	.0350
ADTLT	.8502	.0466	.0173	.0599	.0103	.0157
ADWKI	.8970	.0320	.0127	.0388	.0073	.0122
PAR MNP	.8553	.0455	.0170	.0583	.0100	.0138
CH1 SEX	.8841	.0107	.0227	.0512	.0154	.0160
CH1 AGE	.8625	.0405	.0166	.0549	.0099	.0156
CH1 MAR	.8649	.0411	.0160	.0530	.0095	.0156
CH1 DST0	.4749	.4775	.0010	.0379	.0000	.0086
CH1 DST1	.7708	.1420	.0100	.0595	.0038	.0139
CH1 DST3	.8221	.0695	.0168	.0674	.0093	.0149
CH1 DST4	.7955	.0263	.0330	.1053	.0255	.0144
CH1 DST5	.8930	.0000	.0213	.0543	.0152	.0161
CH1 WRK	.8940	.0002	.0210	.0538	.0148	.0162
CH2 SEX	.7547	.0492	.1024	.0765	.0035	.0136
CH2 AGE	.8552	.0479	.0141	.0579	.0095	.0155
CH2 MAR	.8593	.0451	.0134	.0570	.0097	.0155
CH2 DST0	.6109	.0027	.3521	.0108	.0125	.0110
CH2 DST1	.8267	.0329	.0659	.0478	.0118	.0149
CH2 DST3	.8405	.0444	.0296	.0592	.0111	.0152
CH2 DST4	.7971	.0684	.0157	.0912	.0133	.0144
CH2 DST5	.8621	.0509	.0000	.0623	.0091	.0156
CH2 WRK	.8628	.0506	.0000	.0618	.0093	.0156
CH2 SEX	.8149	.0039	.0896	.0696	.0073	.0147

Note 1:
For the base case:
gender = Female; Age = 80; Educ = 12; Race = White; Parent has no ADLs and no medically needy program; Odd children are female and even children are male; All children are married, work, and live DIST = 2 from the parent; First child is 55, and each other child is 2 years younger than the preceding child.
Note 2:

PAR SEX	is change gender of parent to male;
PAR AGE	is increase age of parent by 5 to 85;
PAR EDUC	is decrease education of parent by 3 to 9;
PAR RACE	is make parent black;
ADBED	is give parent bed ADL;
ADBTH	is give parent bath ADL;
ADDRS	is give parent dressing ADL;
ADEAT	is give parent eating ADL;
ADTLT	is give parent toilet ADL;
ADWKI	is give parent walk inside ADL;
PAR MNP	is give parent medically needy program;
CH1 SEX	is change gender of first child to male;
CH1 AGE	is increase age of first child by 2 to 57;
CH1 MAR	is change marital status of first child to single;
CH1 DST0	is make distance of first child = 0;
CH1 DST1	is make distance of first child = 1;
CH1 DST3	is make distance of first child = 3;
CH1 DST4	is make distance of first child = 4;
CH1 DST5	is make distance of first child = 5;
CH1 WRK	is change work status of first child to not working;
CH2 SEX	is change gender of second child to male;
CH2 AGE	is increase age of second child by 2 to 55;
CH2 MAR	is change marital status of second child to single;
CH2 DST0	is make distance of second child = 0;
CH2 DST1	is make distance of second child = 1;
CH2 DST3	is make distance of second child = 3;
CH2 DST4	is make distance of second child = 4;
CH2 DST5	is make distance of second child = 5;
CH2 WRK	is change work status of second child to not working.

Table 4
Welfare Analysis

Results for 696 Families of Size 1

Average Family Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.466	.234	1.281
UTILIT	-.466	.234	1.281
AUTARC	-.466	.234	1.281
LIMITED UTILIT	-.674	.489	1.282

Parent Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.466	.234	1.281
UTILIT	-.466	.234	1.281
AUTARC	-.466	.234	1.281
LIMITED UTILIT	-.674	.489	1.282

Probability that best choice is chosen: 1.000
Probability the second best choice is chosen: .000

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Results for 397 Families of Size 2

Average Family Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	.039	1.805	1.933
UTILIT	.345	1.526	1.755
AUTARC	-.583	2.046	1.908
LIMITED UTILIT	-.051	1.981	1.812

Parent Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	.167	.243	1.307
UTILIT	.172	.295	1.364
AUTARC	-.129	.354	1.281
LIMITED UTILIT	-.025	.483	1.281

Children Utility Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.127	.439	1.452
UTILIT	.172	.296	1.364
AUTARC	-.453	.443	1.414
LIMITED UTILIT	-.026	.482	1.281

Probability that best choice is chosen: .811
Probability the second best choise is chosen: .157

Results for 455 Families of Size 3

Average Family Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.498	89.081	8.503
UTILIT	8.586	316.094	2.161
AUTARC	-.823	5.407	2.523
LIMITED UTILIT	8.336	311.000	2.220

Parent Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	.312	.048	1.306
UTILIT	-.146	.478	1.363
AUTARC	-.061	.417	1.281
LIMITED UTILIT	-.290	.522	1.281

Children Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.809	86.436	8.310
UTILIT	8.731	315.437	1.861
AUTARC	-.762	2.606	2.172
LIMITED UTILIT	8.626	314.091	1.813

Probability that best choice is chosen: .525
Probability the second best choice is chosen: .105

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Results for 275 Families of Size 4

Average Family Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-1.053	251.823	13.791
UTILIT	23.258	1624.271	2.533
AUTARC	-.705	9.835	3.134
LIMITED UTILIT	23.152	1623.741	2.565

Parent Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	.463	-.030	1.302
UTILIT	-.371	.602	1.325
AUTARC	.043	.428	1.281
LIMITED UTILIT	-.409	.656	1.282

Children Utility Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-1.516	250.101	13.673
UTILIT	23.629	1646.162	2.234
AUTARC	-.748	5.993	2.857
LIMITED UTILIT	23.561	1645.863	2.221

Probability that best choice is chosen: .390
Probability the second best choice is chosen: .241

Results for 129 Families of Size 5

Average Family Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.365	504.380	21.294
UTILIT	38.131	3383.867	2.830
AUTARC	-.994	11.624	3.790
LIMITED UTILIT	38.006	3375.500	2.867

Parent Utility

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	.550	-.063	1.313
UTILIT	-.402	.767	1.319
AUTARC	.029	.319	1.282
LIMITED UTILIT	-.438	.777	1.281

Children Utility :

Model	Mean	Std Dev of Mean	Avg Std Dev
STRATEG	-.915	501.160	21.202
UTILIT	38.534	3421.075	2.566
AUTARC	-1.023	7.993	3.568
LIMITED UTILIT	38.444	3415.565	2.565

Probability that best choice is chosen: .332
Probability the second best choice is chosen: .200

Notes:

1. STRATEG is the strategic play model described in this paper. UTILIT is the model with an omniscient social planner, AUTARC is the model with no care from children allowed, and LIMITED UTILIT is the model with a social planner with limited information.
2. “Std Dev of Mean” is the standard deviation of the mean utility per family. “Avg Std Dev” is the average standard deviation over different draws of the errors across families.

Equilibrium Probabilities